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Estimation of Age from Teeth

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Abstract:

The teeth and oral structures are primarily use in the concern of forensic odontology for the identification in legal context. Various techniques of forensic odontology are help in the identification of human remains in the incidents like airplane, train and road accidents, mass murders, terrorists' attack, natural disasters such as earth quakes, flood and tsunamis etc. Teeth is one of the hardest and well protected structures in human body. By using teeth, we can identify the age of any individual using different methods which play an important role in aspect of life through which person easily identify. Person age is estimated on the basis of mental age, dental age and chronological and bone age and so on. At this time, age estimation is very easier in less time with the help of forensic odontology. This paper is focus on the various aspects of age estimation of teeth such as radiographical, morphological and biochemical methods.

Keywords: *Age Estimation, Morphological, Chronological, Radiographical*

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Introduction

The determination of age in the unidentified skeletal remains is very important for forensic anthropologists. The significant role of forensic anthropologist is to be aware with both the dental and skeletal development at every step of life including the initial step i.e. beginning with the fetus. Age is the part of the biological profile by which list of the missing person is narrow down. From the age estimation, the person may be included or excluded from the thought on the basis of consistency between the reported age and estimated age. The age estimation from the skeleton can be determined through the knowledge of nature, sequence, and timing of the skeletal changes throughout the life time. The correlation between the biological age and chronological age is helpful in age estimation. But due to the variation between the individual's skeletal aging processes, the chronological age and biological age are not completely correlated. Sex and ancestry based variation are affected in the age estimation **(Christensen et al, 243; Zapico, 172; James and Nordby, 87)**.

The development and eruption of teeth in the childhood, children and young adults is used as a gold standard for the age estimation. Root and crown come under the tooth development which are less affected by the sex, nutrition, and ill-health compare to the bone growth and development. Dental development gives more accurate chronological age than other skeletal indicators **(Klepinger, 44).** The rate of tooth growth and the details of tooth morphology vary from population to population, and anomalies appear in individuals, but the stages of development are the same.

The determination of age of the victims and remnants is necessary to solve the legal problems. Various methods are used for the purpose of age from dentition. These are: Clinical or Visual method, Radiographic method, Histological method, physical and chemical method.

Clinical or Visual Method – The eruption of teeth is observed by visually and the changes due to function i.e. attrition is an evidence, used in age estimation.

Radiographic Method – The gross stage of dental development such as tooth organ development, enamel formation and dentin, bud, and cap formation, bell is a prerequisite.

Histological Method – The tissue preparation is required for the microscopic examination detail that can give more accurate result of development of dentition. Also helpful in age of early development of dentition.

Physical and Chemical Method – It is used to determine the alterations in ion levels with age. Do not have a more value in Forensic Odontology **(Senn and Stimson, 281)**.

The factors used to the determination of Age

- Tooth germs appearance
- Mineralization traces are detectable
- Unerupted tooth's completion
- Enamel and neonatal line are formed.
- Eruption of clinical
- Erupted teeth's roots are completed
- Deciduous teeth's resorption
- Crown's attrition
- Physiologic secondary dentin's formation
- Cementum's formation
- Root dentin's transparency
- Gingival recession
- Resorption of root surface
- Staining and discoloration of teeth
- Chemical composition's changes in teeth **(Kaur, Mago, Kaur et.al, 2016; Shamin, Ipe, Shameena, et.al, 2006)**

Dental age estimation can be categorized into three phase:

1. Estimation of age in prenatal, neonatal and postnatal child
2. Estimation of age in children and adolescents
3. Estimation of age in adults **(Nayak, George, Shenoy et.al, 2014)**

1. Estimation of age in prenatal, neonatal and postnatal child

To identify the age of any individual can be very accurate at this group. During the premineralization period, the stage of tooth development can be assess using histological methods. From two or four months in utero, mineralization of deciduous dentition commences. Histological methods can be used for the purpose to detect early mineralization 12 weeks before using to radiographs.

Birth indicates through the line of neonatal. This lines are present in between dentine and enamel of permanent first molars and deciduous teeth that indicate the development during transitional period between extra uterine and intrauterine environments. These are used to evaluate the formation of amount of pre and post-natal enamel. These lines are used for

the purpose of age estimate of foetus or neonates at death.

The differences in enamel prisms' rhythmic mineralization result in the Retzius's incremental lines. The various external factors altered the patterns of rhythmic such as metabolic disturbances due to which lines may be appear to the closer or rest of the periods.

2. Estimation of age in children and adolescents

The children and adolescents' odontological age is estimated by teeth eruption which can be conducted through visual or radiographic methods. Another way is tooth calcification which can be used to measure the dental age of adolescents and children. The formation of crown and root completion can be utilized to identify the age of evidence of radiographical. In case of sufficient ante-mortem records are available, then utilize the radiographs for age identification purpose. Through using radiographs, various alteration can be studied such as pathological and morphological study. Various stages of wound heals, root formation, bone trabecular pattern, decayed, filled, missed and fractured teeth are present, using of radiographs method for identification of age.

Figure: Stages of Tooth Eruption

3. Estimation of age in adults

About the age of 20-22 years at tooth formation end, the stages of development of tooth are employing by using methods. In this section, estimation of age is very difficult using teeth. In adult age, the techniques are used to evaluate the progression of wear and age changes in teeth. In adults, various regression changes are occurred like hard and soft tissues of teeth that can be use in different methods **(Nayak, George, Shenoy et.al, 2014; Shamin, Ipe, Shameena, et.al, 2006)**.

In Forensic Odontology, Gustafson method is a morphological method and widely used in the age estimation from teeth. The six age- progressive changes were noticed by Gustafson in his study **(Senn and Stimson, 281)**

1. Occlusal Attrition (A) –

A0 – No attrition
A1 – Attrition limited to enamel Level
A2 – Attrition limited to dentin level
A3 – Attrition up to pulp cavity

2. Periodontosis (P) –

P0 – No obvious periodontal disease
P1 – Beginning of periodontal disease but no bone loss
P2 – bone loss more than one- third of the root
P3 – Bone loss more than two- third of the root.

3. Secondary Dentin (S) –

S0 – No secondary dentin formation
S1 – Secondary dentin up to upper part of pulp cavity
S2 – Secondary dentin up to two- third of the pulp cavity
S3 – Secondary dentin of entire pulp cavity

4. Cementum Opposition (C)–

C0 – Normal cementum
C1 – Thickness of cementum but normal
C2 – Abnormal thickness of cementum near the apex of the root
C3 – Generalized abnormal thickness of cementum throughout the apex of the root

5. Root Resorption (R)–

R0 – No resorption
R1 – Spotted Resorption
R2 – Resorption limited to cementum
R3 – Extensive resorption of cementum and dentin both

6. Root Transparency (T) –

T0 – No transparency
T1 – Beginning of Transparency
T2 – Transparency more than one-third of the apical root
T3 – Transparency more than two-third of the apical root

$$A_n + P_n + S_n + C_n + R_n + T_n = \text{Points}$$

The equation calculated was as:

$y = 11.43 + 4.56x$

Where, y = age

x = points **(Priyadarshini, Puranik and Uma, 20; Singh et al)**

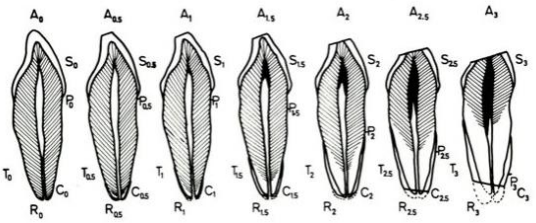

Figure: Changes in Tooth

Some histological methods are consider for age estimation from which is as follow:

Bang and Ramm Method for Dentinal Translucency

Both scientist was the first to use dentinal translucency for identification of age from teeth. Root translucency is visible at the 3rd decade of life and increase with the age which was concluded by both scientists. The differences were occurred due to decrease dentinal tubules' diameter which was caused by increasing intratubular calcification. In case of increasing of age, then increasing of dentinal translucency towards crown.

Cementum's Incremental Lines

According to Grupe and Kagerer, acellular cementum incremental lines are to estimate the age of teeth. In incremental lines, hypominiralized bands are occurred which indicate some situation such as skeletal trauma, pregnancies, renal disorder etc. This method has major disadvantage is that teeth may require to extract through which it is feasible in case of dead person, not living.

Attrition's Average Age

This method was introduce by Li and Ji in which described the degree of attrition with age. With increasing the age, degree of attrition also increase, concluded by them **(Singh and Singal, 2017)**.

Conclusion

The estimation of age from teeth contains the major problem such as the age, disease in teeth, presence of only single teeth etc. To overcome from these problems, there is need of considerable experience in the identification of some changes. Teeth are majorly used for the purpose of age estimation because they display the number of observable age according to the variable. In this paper, we discussed about the various methods to estimate the age from teeth in which we concluded that radiographs and Gustafson's method are appropriate and reliable for age estimation. Through using these method, age is easily estimated.

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